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Certifying Officer

13281 U.S.PTO

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

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☐ Additional inventors are being named on the _____ separately numbered sheets attached hereto

TITLE OF THE INVENTION (500 characters max)

MIDDLEBOX FLOW TRAVERSAL REGISTRATION

22581 U.S.PTO 60/530904 122203

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ENCLOSED APPLICATION PARTS (check all that apply)

☒	Specification	*Number of Pages:* 6	☐	CD(s), Number	
☐	Drawings	*Number of Sheets:*	☐	Other (specify)	
☒	Application Data Sheet				

METHOD OF PAYMENT OF FILING FEES FOR PROVISIONAL APPLICATION FOR PATENT

☐ Applicant(s) claims small entity status.

☒ A check is enclosed in the amount of **$160.00** for the filing fee.

☐ The Commissioner is authorized to charge filing fees or credit any overpayment to Deposit Account No. 25-0120

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No

☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

Docket No.: **1510-1077**

By: Thomas W. Perkins 37,855
for Thomas W. Perkins, Reg. No. 33,027

Date: **December 22, 2003**

TWP/lmt

PROVISIONAL APPLICATION FILING ONLY

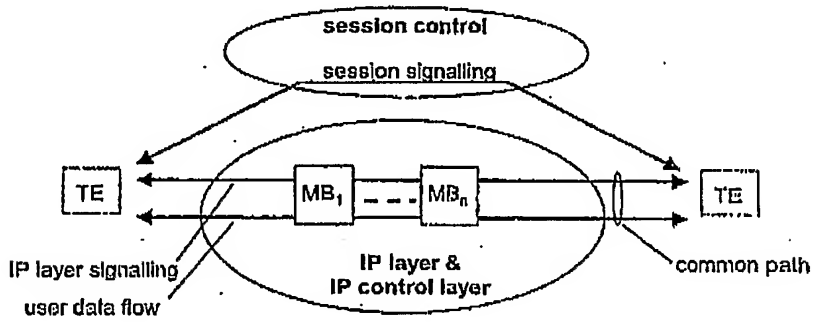
1 Titl of the Invention

Middlebox flow traversal registration.

2 Background

2.1 Technical Background/Existing Technology

The TCP/IP protocol suite has two separate signalling layers, one at the session layer, and one at the IP layer. An example of a session layer signalling protocol is SIP. An example of an IP layer signalling protocol is RSVP. To set up a session with reserved resources, signalling at both layers is needed. The signalling at the session layer may follow a different path than the user data. The IP layer signalling follows the same path as the user data. This is illustrated in Figure 1. In this case the control functions for a specific IP flow are distributed among the nodes (middleboxes and routers) along the path of the flow.



MB Middlebox or rout

Figure 1. Common path for IP layer signalling and user data flow.

In multi-access scenarios with multiple radio hops and requirements on session continuity in complex handover situations, an IP layer signalling protocol can be used to transfer control messages to middleboxes such as network address translators, firewalls, etc. to ascertain that an user data IP flow is processed correctly. This aspect of IP layer signalling is addressed by the IETF NSIS working group [nsis].

There is also a need to coordinate the resource utilization and the configuration of firewalls and other types of middleboxes. For coordination purposes, the use of a centralized control entity is favourable. The definition of such an entity, called a Midcom Agent, is addressed by the IETF Midcom working group [midcom].

The Go interface described in [23.207] allows the Policy Decision Function (PDF) to apply policy to the bearer usage in the GGSN [RFC 2748]. Requests for policy decisions are sent by the the GGSN over the Go interface to the PDF. For example "Is it OK for IP flow X to use 100 kbps of bandwith?".The PDF responds with a policy decision, e.g. "not OK". There is a client-server relation over the Go interface between the GGSN and the PDF.

On the other hand, in the proposal below, there is a master-slave relation between the Midcom Agent and the flow specific state machine in a middlebox. The master-slave relation is used to allow the Midcom Agent to exercise control of the flow specific state machine in the middleboxes. One of the ideas in this ID is a registration procedure, where the slave registers with the master. Some overlap exists with the authorization and identification procedure over the Go interface, see section 6.1.3 of [23.207].

2.2 Problems with existing solutions

When using a Midcom Agent, the signalling messages for a specific session do not necessarily traverse the same routers and middleboxes as the user data flow of the session. The control plane must therefore determine which routers and middleboxes a specific IP flow traverses so that it can direct control messages related to this flow to these nodes. The existing solutions handle policy control, or control of firewalls and address translators, but do not fully address the objective of the idea described below, that is to establish communication for general purpose connection control between Midcom Agents and middleboxes.

The use of two separate signalling protocols to set up a session introduces unnecessary complexity and is a waste of bandwidth, especially over radio interfaces.

3 Basic Concept

The Midcom Agent determines which routers and middleboxes a specific IP flow traverses by receiving a specific flow registration message that is sent from each of the nodes that a user data IP flow traverses. The control plane can thereby direct control messages related to the user data IP flow to the middleboxes and routers along the path that the flow traverses. This is illustrated in Figure 2.

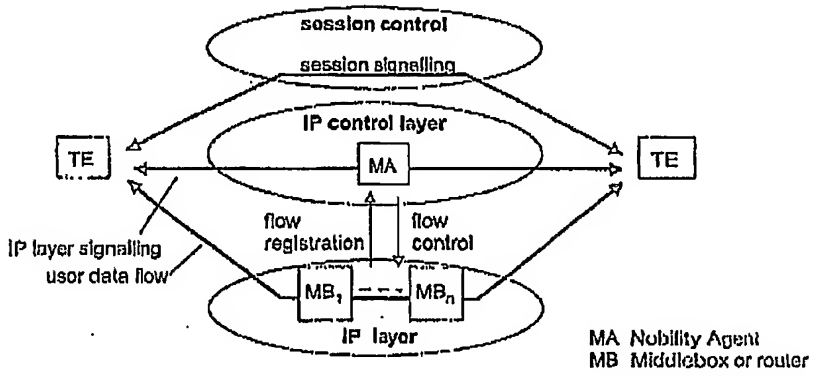


Figure 2 Flow registration signalling according to the invention.

By decoupling the IP layer signalling path from the user data path, it is possible to co-locate the IP layer control nodes with the session layer control nodes. The information elements carried by the IP layer signalling mechanism can then be moved to the session layer signalling mechanism. This means that the session layer signalling mechanism handles the tasks of the IP layer signalling mechanism, and the latter is then not needed. This is illustrated in Figure 3.

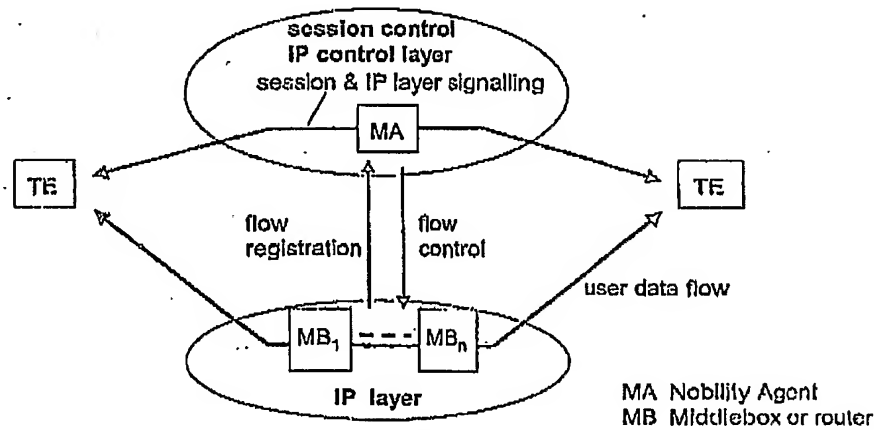


Figure 3 Using session layer signalling also for IP layer signalling

messages.

4 Detailed description

4.1 Detailed Technical Description of the Invention

The basic idea of the invention is illustrated in Figure 4. The Midcom Agent handles the control functions for the flow. These functions are related to resource control, firewalls, network address translators, etc. The control functions are performed according to the session parameters for bandwidth and QoS that are negotiated using the session layer signalling protocol. Also the flow identity is determined during the session signalling (step 1 in the figure). The flow identity can for example be defined by the source and destination IP addresses and port numbers plus the protocol identity in the IP header.

In a multi-access scenario, a node such as a router or a middlebox may enter into the path of a user data flow during a session as a consequence of user movement. For example, during a session the user may enter a train with a local network and a local firewall. In such cases a registration procedure will be needed to continuously update the control plane about the nodes that are present along the path of a flow, and their functional capabilities.

Using a standard agent discovery procedure, the node finds the address of the Midcom Agent (step 2 in the figure). The node then registers its identity and functional capabilities with the Midcom agent (step 3 in the figure). When the node detects an IP flow it sends a registration message for the flow to the Midcom agent (step 4 in the figure).

The registration message contains a flow identity and a node address. The flow identity is also used in the session layer signalling, and the session layer control plane can match the flow identity in the session signalling with the flow identity in the flow registration message. The session layer control plane will then be able to send control messages to the routers and middleboxes along the path of the IP flow to ascertain that the flow is processed correctly (step 5 in the figure). In a mobile multi-access scenario, some of these nodes may enter or leave the path of the flow during the lifetime of a session.

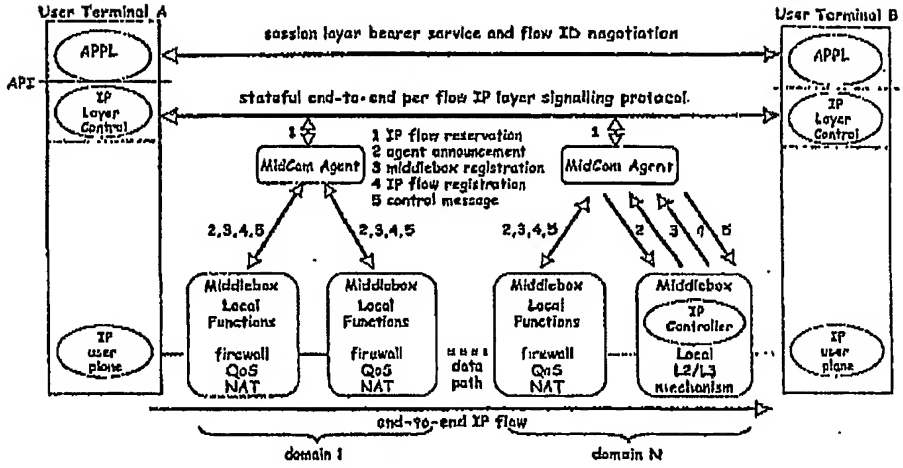


Figure 4 Example of registration of flows traversing middleboxes.

The procedure is described in more detail in the flow diagram in Figure 5.

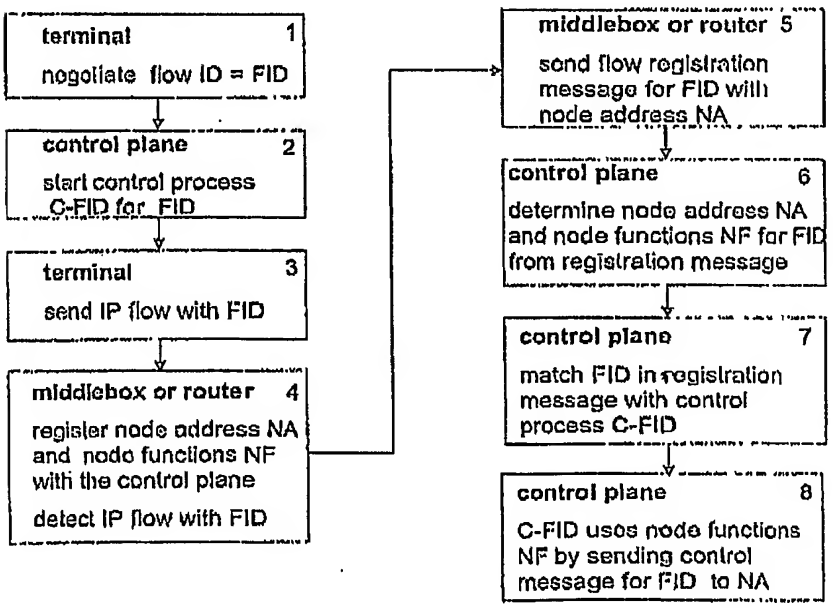


Figure 5 Flow diagram for the IP flow registration procedure.

4.2 Advantages of the Invention

The invention allows for decoupling of IP signalling from the user data path. This facilitates centralization and coordination of connection control functions over a multi-access network. Moreover, it facilitates merging of session layer and IP layer signalling protocols into one protocol, which reduces complexity and signalling overhead.

5 Abbreviations

C-FID	Controll process for flow with identity FID
FID	Flow Identity
MA	Midcom Agent
MB	Middlebox
Midcom	Middlebox Communication
NA	Node Address
NF	Node Functions
NSIS	Next Steps in Signalling

6 References

RFC 2748: The COPS (Common Open Policy Service) Protocol
http://www.ietf.cnri.reston.va.us/rfc/rfc2748.txt

IETF NSIS working group
http://www.ietf.cnri.reston.va.us/html.charters/nsis-charter.html

IETF Midcom working group
http://www.ietf.cnri.reston.va.us/html.charters/midcom-charter.html

[23.207] 3GPP specification 23.207: End-to-end QoS Concepts and Architecture, rev. 5.8.0
http://www.3gpp.org/ftp/Specs/html-info/23207.htm

Application Data Sheet

Application Information

Application Type::	Provisional
Subject Matter::	Utility
Suggested Classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Number of CD disks::	
Number of Copies of CDs::	
Sequence Submission?::	None
Computer Readable Form (CRF)::	No
Number of copies of CRF::	0
Title::	MIDDLEBOX FLOW TRAVERSAL REGISTRATION
Attorney Docket Number::	1510-1077
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	
Total Drawing Sheets::	3
Small Entity?::	No
Latin Name::	
Variety Denomination Name::	
Petition Included?::	No
Petition Type::	
Licensed US Gov't Agency::	
Contract or Grant Numbers::	
Secrecy Order in Parent Appl.?::	No

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Correspondence Customer Number:: 000466

Representative Information

Representative Customer Number::	000466

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::

Foreign Priority Information

Country::	Application Number::	Filing Date::	Priority Claimed::

Assignment Information

Assignee Name::

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City of Mailing Address::

State or Province of Mailing Address::

Country of Mailing Address::

Postal or Zip Code of Mailing Address::